## 1. Scope

This procedure describes a method for the separation of Zr-89 from irradiated Y targets. This method has been tested up to 300 mg Y.

## 2. Summary

Zr-89 is separated from irradiated Y target material as well as from impurities potentially present like Fe, Ti, Nb,... The separation is performed using the hydroxamate based ZR Resin. The separation can be performed using prepacked ZR Resin cartridges (here 0.3 mL cartridges) or self-packed cartridges containing 100 mg ZR Resin (corresponding to 0.3 mL). Zr-89 is, after its purification, eluted from the ZR Resin using 0.05 M oxalic acid. Higher oxalic acid concentrations may be used instead, and their use will result in smaller elution volumes.

## 3. Significance of use

This method is a rapid and reliable method for the purification of Zr-89 from dissolved Y targets.

## 4. Interferences

Interferences such as i.e. Fe, Al, Y, Ti and Nb are removed from the Zr-89 during the separation process. For Y targets with a mass >300 mg larger ZR Resin cartridges may need to be employed.

## 5. Apparatus

- Analytical balance- 0.0001 g sensitivity
- Beaker (10 mL, 50 mL)
- Vials
- Pipettes
- Fume hood
- Column holder
- Alternatively, a vacuum box system incl. vacuum pump or a positive pressure set-up (e.g. synthesizer or peristaltic pump based) might be used
- Empty columns e.g. AC-142-TK (or empty cartridges e.g. AC-100-R01 in case of use of a vacuum or positive pressure system) incl. appropriate frits

⚠ Note: Alternatively, commercially available prepacked cartridges may be used (e.g. reference ZR0.3-R10-S contains 100 mg ZR Resin).



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⚠ Note: A small amount of extractant may bleed from the ZR Resin during Zr elution, this may be addressed using a guard column (e.g. using Prefilter Resin).

⚠ Note: In case Zr-89 would preferably be obtained as chloride or citrate TBP Resin may be used as an alternative (Graves et al., 2018).

## 6. Reagents

### a. Reagents

All references to water should be understood to mean deionized water (18 MΩ).

- Hydrochloric acid (HCl), 37%, p.a.
- 2 M HCl - Add ca. 600 mL of water in to a 1000 mL volumetric flask. Add 167 mL concentrated hydrochloric acid. Complete with water.
- Alternative: 6 M HCl - Add ca. 400 mL of water in to a 1000 mL volumetric flask. Add 500 mL concentrated hydrochloric acid. Complete with water.
- 0.05 M oxalic acid – Weigh 450 mg of anhydrous oxalic acid or 630 mg oxalic acid dihydrate into a 100 mL volumetric flask. Add ca. 80 mL of water to dissolve the oxalic acid. Complete with water. This solution should be prepared freshly.

⚠ Note: oxalic acid solutions of higher concentrations may be used

- ZR Resin (Dirks et al., 2015) – Bulk s grade resin or prepacked 0.3 mL cartridges

### b. Preparation of solutions

## 7. Procedure

### a. Sample preparation

1. Per column to be packed weigh 100 mg of the resin into a suitable vial (e.g. 2 mL Eppendorf cap)
2. Add 1-3 mL of water (alternatively 2 M HCl may be used) and allow resin to soak for at least 30 min, preferably while shaking
3. Allow column and frits to soak in water for at least 30 min
4. Place appropriately sized containers below the column
5. Empty soaked columns
6. Transfer soaked resin into empty column, allow to settle
7. Place frit on top of resin. Do not compact the resin (ideally the frit should remain approx. 1 mm above the resin bed)
8. Break tip and allow liquid to pass the column

### b. Radiochemical separation

1. Pass 3 mL of 2 M HCl through the column to precondition (in case the dissolved target is loaded from 6 M HCl precondition with 3 mL 6 M HCl).



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2. Load dissolved target (2 M or 6 M HCl, the dissolution may e.g. be performed as described in (Holland et al., 2009)) onto the column

⚠ NOTE: The method has been tested or up to 300 mg stable Y

3. Rinse column with four times 2.5mL 2 M HCl
4. Rinse column with four times 2.5 mL water
5. Place clean labelled container below column
6. Elute Zr using 1.5 mL 0.05 M oxalic acid

⚠ NOTE: Higher concentrations of oxalic acid may be used, this will typically also lead to a slight decrease of the elution volume


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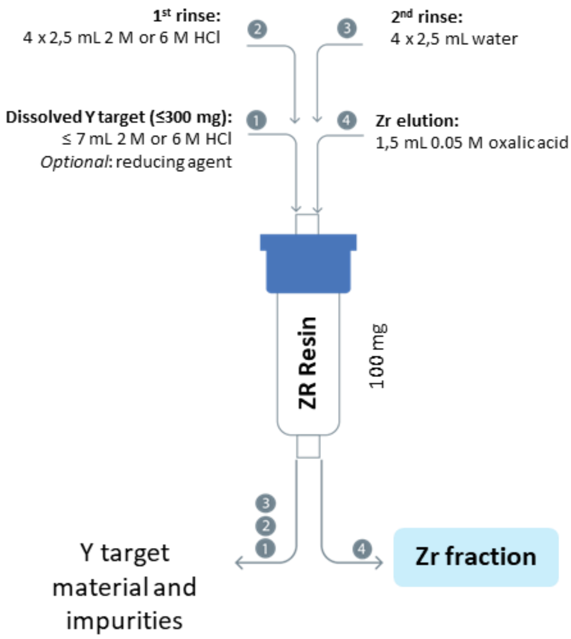
### c. Summary of radiochemical separation




## 8. References

Dirks, C., Bombard, A., & Maudoux, N. (2015). On the development and characterisation of an hydroxamate based extraction chromatographic resin. *Presented at the 61st RRMC, October 25th–30th*. https://doi.org/http://www.rrmc.info/rrmc-61/rrmc-61-062a.pdf

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